

Application Number 10/800,390
Amendment dated 22 November 2006
Reply to Office Action of 24 July 2006

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Remarks

Applicants have neither added nor cancelled any claims in this response. Therefore, Claims 1-27, 29-36 and 64-77 remain pending in this application. Claims 31-36 and 64-77 have been withdrawn from consideration.

Interview Summary.

Applicants thank the Examiner for conducting a personal interview on 24 October 2006. The following summarizes the substance of the interview, in accordance with the guidelines provided by MPEP 713.04.

- (A) No exhibits were shown, and no demonstration was conducted.
- (B) Claims 1-27, 29 and 30 were discussed.
- (C) European Patent Application Publication EP 0 858 101 A2 ("Aoyama"), U.S. Patent 6,875,279 ("Chu"), and U.S. Patent 6,875,279 ("Kanzawa") were discussed.
- (D) Applicants proposed to amend Claim 1 as presented in this paper.
- (E) Applicants pointed out why neither Aoyama nor Chu nor Kanzawa can anticipate amended Claim 1.
- (F) No other pertinent matters were discussed.
- (G) Examiner agreed to fully consider Applicants' amendments when formally submitted.

Claim Amendments.

Applicants have amended independent Claim 1 to clarify that the surface active compound is present during a more clearly defined temperature "ramp down time period". Applicants have also amended independent Claim 1 to recite that "the epitaxial layer is deposited using a precursor or precursor mixture that is different from the surface active compound". This amendment was made to distinguish prior art wherein the precursors used during the epitaxial deposition are also present during the ramp down time period. This feature is fully supported by the originally-filed application

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disclosure. For example, paragraph [0080] describes an embodiment wherein dichlorosilane is used as an example surface active compound that is contacted with a single crystal surface during a cooling time period. Paragraph [0082] goes on to describe depositing an epitaxial germanium layer on the single crystal surface at a second temperature "by introducing a germanium source" to the reaction chamber. The disclosure of this embodiment makes clear that a different precursor is added for the epitaxial deposition at the second temperature, regardless of whether the surface active compound continues to be supplied to the reaction chamber. Applicants respectfully submit that the foregoing disclosure clearly indicates that they invented the method recited in amended Claim 1, wherein "the epitaxial layer is deposited using a precursor or precursor mixture that is different from the surface active compound".

Claim Rejections Under 35 U.S.C. § 102.

Claims 1–6, 9–13, 15–20, 25–27 and 29 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Aoyama, by Chu, and by Kanzawa. Claim 1 is independent and Claims 2–6, 9–13, 15–20, 25–27 and 29 depend therefrom.

Aoyama teaches cooling a single crystal silicon structure from 650°C to 600°C or less, for example 550°C. Aoyama then teaches forming a silicon germanium epitaxial layer at a temperature of 600°C or less by contacting the single crystal silicon structure with a surface active compound. See Aoyama at 7:11–43. Chu discloses forming a silicon layer, reducing the temperature to 650°C, and then initiating silane flow. See Chu at 7:64–8:5. Kanzawa discloses methods for forming carbon-doped silicon germanium films wherein a wafer is subjected to a 800°C hydrogen bake, is cooled to 490°C, and, "while keeping this temperature," is exposed to Si₂H₆, GeH₄ and SiCH₄ to epitaxially grow a carbon-doped silicon germanium film. See Kanzawa at 5:33–48.

Applicants have amended independent Claim 1 to specifically recite "ramping down the single crystal Si structure to a second temperature during a ramp down time period, wherein the ramp down time period terminates when the second temperature is reached". Thus, Claim 1 now specifically defines a "ramp down time period" that terminates when a second temperature is reached. Claim 1 further recites "contacting

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the single crystal Si structure with a surface active compound during at least a portion of the ramp down time period" (emphasis added). As discussed during the interview on 24 October 2006, amended Claim 1 cannot be anticipated by any of the cited references.

Specifically, none of the cited references discloses contacting a single crystal silicon structure with a surface active compound during at least a portion of a ramp down time period that terminates when a second temperature is reached. For example, the cited portions of Aoyama only teach cooling to a stable temperature follow by deposition at that cooler temperature, not during the temperature ramp down. Likewise, Chu does not teach or suggest contacting with a surface active compound while the single crystal silicon structure is being cooled. Finally, Kanzawa specifically teaches exposure to those compounds after cooling while at a steady state temperature.

Based on the foregoing, Applicants submit that none of Aoyama, Chu and Kanzawa discloses all of the elements recited in amended Claim 1, and therefore none of these references can anticipate that claim. Therefore, Applicants respectfully request that these rejections be withdrawn. Furthermore, because Claims 2-6, 9-13, 15-20, 25-27 and 29 depend from independent Claim 1, and recite additional distinguishing features, Applicants submit that Claims 2-6, 9-13, 15-20, 25-27 and 29 are allowable for at least the same reasons that independent Claim 1 is allowable, and respectfully request that these rejections be withdrawn as well.

Claim Rejections Under 35 U.S.C. § 103.

Claims 7, 8, 14, 21-24 and 30 stand rejected as unpatentable over Aoyama, over Chu, and over Kanzawa. Claims 7, 8, 14, 21-24 and 30 all depend from independent Claim 1. To establish a *prima facie* case of obviousness, all the claim elements must be taught or suggested by the prior art (see MPEP 2143.03). Applicants respectfully submit that not all of the claim elements are taught by the asserted art because, for example, none of these references discloses "contacting the single crystal Si structure with a surface active compound during at least a portion of the ramp down time period" (emphasis added), wherein the ramp down time period "terminates when the second

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temperature is reached," as is recited in Claim 1. The failure of the cited references to disclose this element is discussed above.

The prior art can be modified or combined to reject claims as *prima facie* obvious only if there is a reasonable expectation of success (see MPEP 2143.02). Prior to the present invention, a skilled artisan would not have expected that modifying any of the cited references to continue the growth step during cooling would yield successful results because dynamic temperature fluctuations during cooling could detrimentally affect film uniformity and thickness. See Paragraph 9 of the Declaration of Dr. Matthias Bauer Under 37 C.F.R. § 1.132 (filed 24 March 2006). Benefits associated with reducing the amount of deposition during the cooling period are also disclosed in the originally filed application disclosure at, for example, paragraphs [0080] and [0081].

Therefore, based on the foregoing, Applicants submit that Claims 7, 8, 14, 21-24 and 30 are allowable over Aoyama, over Chu and over Kanzawa, and respectfully request that these rejections be withdrawn.

Conclusion.

In view of the foregoing amendments, the Applicants submit that this application is in condition for allowance, and respectfully request the same. If, however, some issue remains that the Examiner feels can be addressed by an Examiner's Amendment, the Examiner is cordially invited to call the undersigned for authorization.

Respectfully submitted,

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